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Optical properties of photovoltaic Cu_2SnS_3 films deposited on soda lime glass and Mo-coated glass

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Deposited by	Annealed in	Characterized by	Quantities obtained	Preliminary analysis	Preparation
Pulsed laser ablation	Sulfur atmosphere at 570°C	Spectroscopic ellipsometry	Dielectric functions, thicknesses and roughnesses of layers	**Cubic** Cu_2SnS_3 phase (Raman). Expected band gap: 0.9 -1.1 eV. **MoS_2** is formed during annealing.	Small CTS film thickness to limit roughness effects

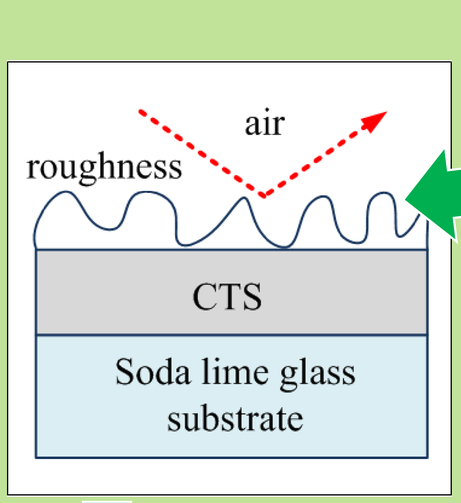
APPROACH: The bare substrate is measured and fitted by ellipsometry. Then the measurement is repeated each time a new layer is grown on top of the film stack. Requirements on the dielectric functions are Kramers-Kronig consistency and $\varepsilon_2 > 0$

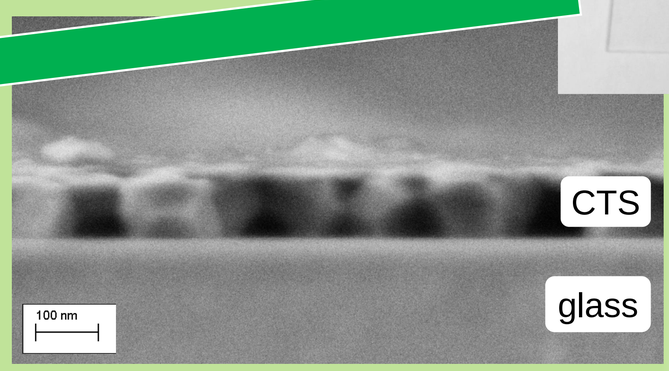
Bare soda lime glass

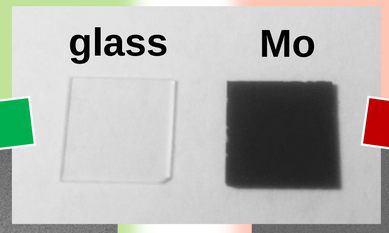
PROS	CONS
Easy analysis	Not a realistic substrate for solar cells. Properties may be different than on Mo.

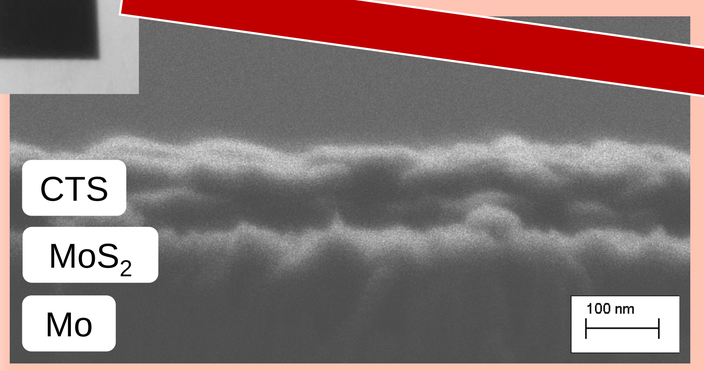
Mo-coated soda lime glass

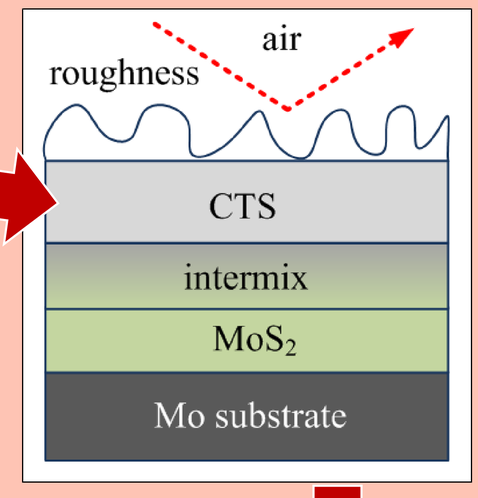
PROS	CONS
Realistic substrate for solar cells	Difficult analysis. Correlation between fitting parameters. Possibility of artifacts.

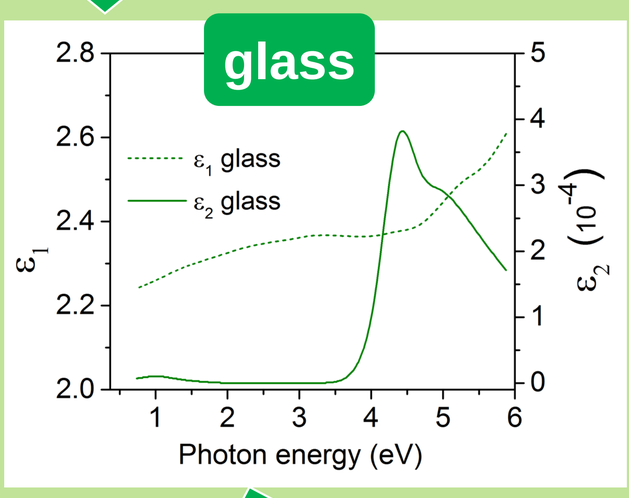












CTS thickness:
- 141.42 ± 0.037 nm (ellips.)
- 130 nm ± 10 nm (SEM)

CTS roughness:
- 14.99 ± 0.025 nm (ellips.)

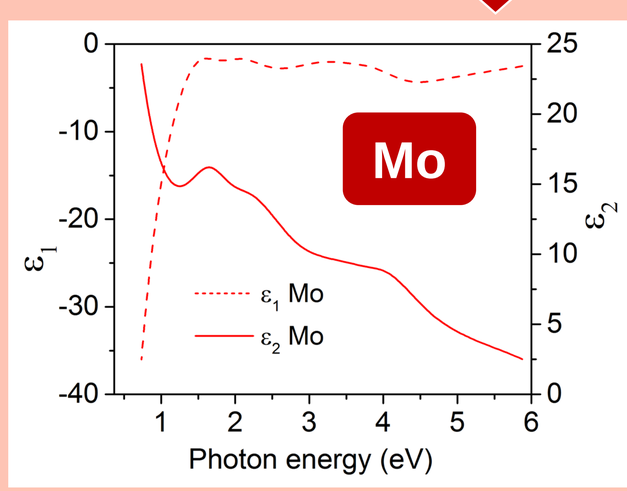
- Double band gap at **0.92 / 1.02 eV**
- Low dispersion above band gap

CTS thickness:
- 108.76 ± 0.209 nm (ellips.)
- 110 nm ± 10 nm (SEM)

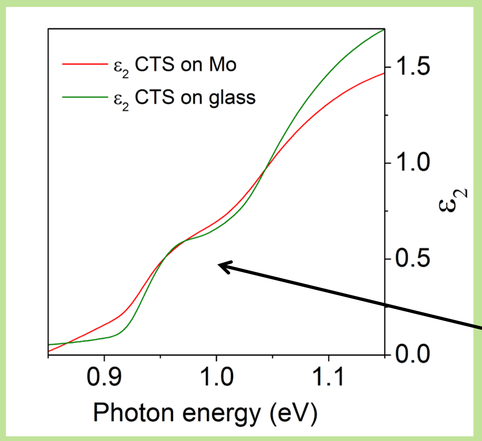
CTS roughness:
- 17.09 ± 0.117 nm (ellips.)
- 110 nm ± 10 nm (SEM)

Intermix layer thickness:
- 17.79 nm (ellips.)

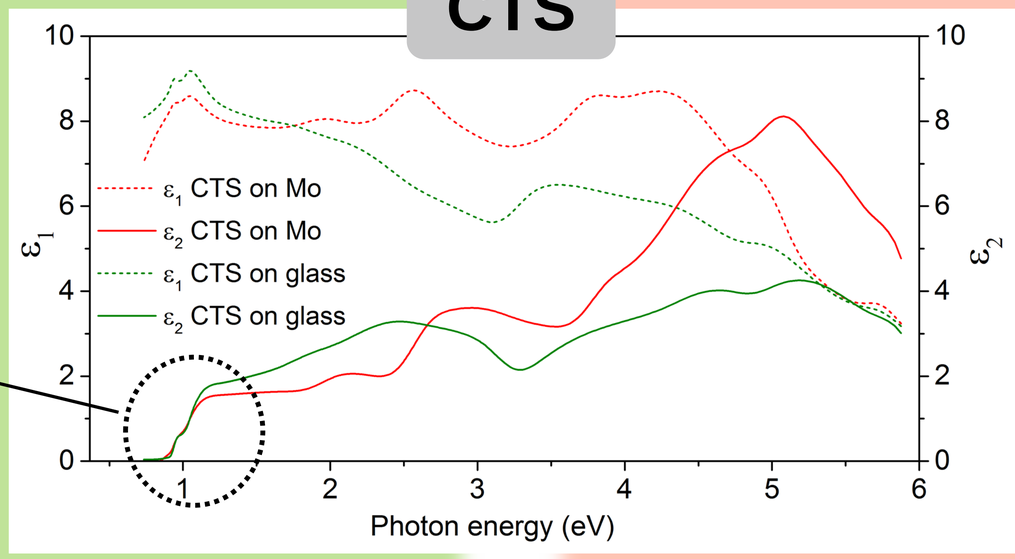
- Double band gap at **0.91 / 1.02 eV**
- Strong excitonic peaks in the UV

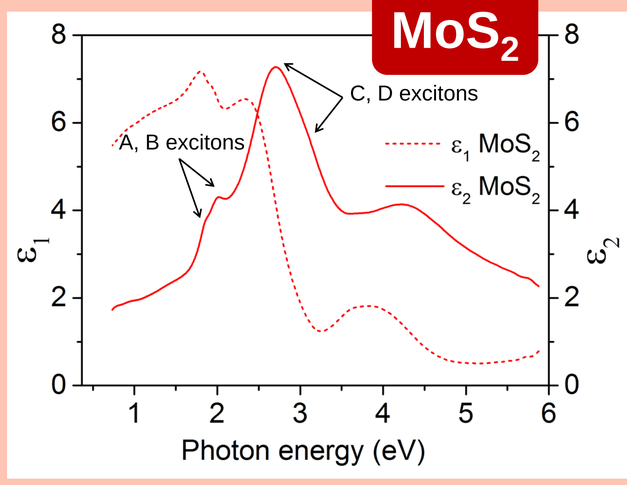


MoS_2 thickness:
- 53.56 nm (ellips.)
- 55 nm ± 5 nm (SEM)



Double band gap





Mean square error: **4.151**

Mean square error: **7.194**

Acknowledgments

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